PDG Meson Team

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Activities toward RPP-2006

Flood of new results in the heavy quark sector

- 302 papers selected [170 in RPP2004]
  - 155 experimental (BES:45, CLEO:36, BaBar:23, Belle:9, Others:42)
  - 147 theory and phenomenology (ORP and minireviews)
- 717 new measurements [449 in RPP2004] :
  - 141 unflavored mesons [258 in RPP2004]
  - 388 $c\bar{c}$ mesons, 104 regarding $\psi(2S)$ [82 new entries for $c\bar{c}$ in RPP2004]
  - 64 $b\bar{b}$ mesons [9 in RPP2004]
- New particles, the club of "spectroscopy puzzles" keeps growing

  $X(1835)$ (BES)

  $D_0^*(2400)$ charged and neutral, $D_1(2430)^0$ (Belle/FOCUS)

  $\chi_{c2}(2S)$, $Y(3940)$, $Y(4260)$ (Belle/BaBar)

  $\Upsilon(1D)$ (CLEO)

  h_c finally and unambiguously confirmed (CLEO)
- Standalone fit for $\psi(2S)$ and $\chi_c(1P)$ branching ratios updated with new measurements and 4 more parameter
- 10 minireviews, 7 updated

Meson Team Members and responsibilities

Claude Amsler	Zurich	Notes	
Michael Doser	CERN	Management, Notes	
Simon Eidelman	Novosibirsk	Literature, notes	
Thomas Gutsche	Tuebingen	Notes theory	New member
Juan-Jose Hernandez	Valencia	Notes	
Alberto Masoni	Cagliari	Notes	
Sergio Navas	Granada	Notes	
Claudia Patrignani	Genova	Notes	
Nils Tornqvist	Helsinki	Notes, theory	

All of us "encoders" and "overseers" (LBL terminology) for unstable mesons

Ongoing discussions about one more experimentalist for the heavy quark sector

Meson team encoding procedures

- Each group member mainly (but not exclusively) responsible for particles with a specific set of quantum numbers - scalars, vectors, etc.
- Papers selected during literature search (every 2 months) assigned to a "first reader" who writes a summary note in LaTeX specifying what and how should go to the database.
- The first reader selects a second reader who adds his criticism and comments. Iterative procedure starts if needed until both readers agree.
- a latex note is written for every paper, also for those that are ultimately not sent to LBNL
- The latex note approved by two readers is uploaded into meson team website (for future reference) and it is sent to LBL where Piotr Zyla codes the input into the Database.
- The first reader checks the results of the input.

Fitting for $\psi(2S)$ and $\chi_c(1P)$ branching ratios

- Experiments measure product or ratios of branching ratios, often involving more than one particle.
- the standalone *cross particle* fitting introduced in RPP2002 to avoid hidden correlation grows as experiments measure new combination of branching ratios and/or partial widths
- introducing a new parameter in the fit implies re-coding of old measurement
- non standard procedure done mostly "by hand" and implies a non negligible workload on both meson team and LBNL:
  - input cannot be retrieved from the DB, must be hard-coded into the fitting program
  - special care must be taken to avoid errors: two independent fitting programs (Fortran and C, both based on MINUIT) to cross check result (central values, errors, correlations)
  - Fit output sent to LBL where it's entered by hand into the Database. Proof-reading, etc.

A new cross-particle fitting?

Particles involved $\eta_c(1S)$, $J\psi$, $\psi(2S)$, $B^\pm$

$\mathcal{B}(J/\psi \to \eta_c\gamma)$	$\mathcal{B}(J/\psi \to \eta_c\gamma)\mathcal{B}(\eta_c \to K\bar{K}\pi)$	$\mathcal{B}(J/\psi \to \eta_c\gamma)\mathcal{B}(\eta_c \to p\bar{p})$
$\mathcal{B}(\psi(2S) \to \eta_c\gamma)$	$\mathcal{B}(\psi(2S) \to \eta_c\gamma)\mathcal{B}(\eta_c \to K\bar{K}\pi)$	$\mathcal{B}(\psi(2S) \to \eta_c\gamma)\mathcal{B}(\eta_c \to p\bar{p})$
$\mathcal{B}((B^\pm \to \eta_c K^\pm)$	$\mathcal{B}((B^\pm \to \eta_c K^\pm)\mathcal{B}(\eta_c \to K\bar{K}\pi)$	$\mathcal{B}((B^\pm \to \eta_c K^\pm)\mathcal{B}(\eta_c \to p\bar{p})$
	$\Gamma(\eta_c \to \gamma\gamma)\mathcal{B}(\eta_c \to K\bar{K}\pi)$	$\Gamma(\eta_c \to \gamma\gamma)\mathcal{B}(\eta_c \to p\bar{p})$

For the moment correlations can still be avoided by considering the following set of independent measurements

$\mathcal{B}(J/\psi \to \eta_c\gamma)$	$\mathcal{B}(J/\psi \to \eta_c\gamma)\mathcal{B}(\eta_c \to K\bar{K}\pi)$
$\mathcal{B}(\psi(2S) \to \eta_c\gamma)$	$\mathcal{B}(\psi(2S) \to \eta_c\gamma)\mathcal{B}(\eta_c \to K\bar{K}\pi)$
$\mathcal{B}((B^\pm \to \eta_c K^\pm)$	$\mathcal{B}((B^\pm \to \eta_c K^\pm)\mathcal{B}(\eta_c \to K\bar{K}\pi)$
$\Gamma(\eta_c \to \gamma\gamma)\mathcal{B}(\eta_c \to K\bar{K}\pi)$	$\dfrac{\mathcal{B}(\eta_c \to p\bar{p})}{\mathcal{B}(\eta_c \to K\bar{K}\pi)}$

Not always what experiments have quoted. Listing should be updated in a few cases to reflect that

By doing so we do not exploit the constraint on $\mathcal{B}((B^\pm \to\to \eta_c K^\pm)$ derived from the three set of measurements above to a common value: could improve $\mathcal{B}(J/\psi \to \eta_c\gamma)$, $\mathcal{B}(\psi(2S) \to \eta_c\gamma)$, and $\mathcal{B}((B^\pm \to\to \eta_c K^\pm)$.

Requires anyway coordination with the B-meson group and HFAG

Other problems

Excellent collaboration with Piotr Zyla but he has to manually enter all meson team encoding.

Can become hardly manageable if the paper flow increases further

New software is badly needed to allow direct access to the database and one-step implementation of the data ,without elaborate coding sent to Piotr.

Eagerly waiting for a second round of testing with the new encoder interface!

Perspectives

Very active field:

- B-factories are not just for "B physics": a steady flow of results (and surprises) also for unstable meson
- BES-II ($c\bar{c}$, and light mesons) and CLEO (($c\bar{c}$ and $b\bar{b}$) will be actively publishing in the next few years
- KLOE (ϕ factory) started publishing
- VEPP-2M closed but still providing results
- in 1-2 years BES-III and VEPP-2000 will begin operations
- on a longer term: experiments at GSI

Paper flow might even significantly increase in the next few years for charmed, charmonium(-like) and bottomonium mesons.